

WHAT IS CLAIMED IS:

- 1 Jul 7
2 comprising:
3 providing a receptacle having an enclosed chamber containing an amount
4 of a powder; and
5 providing at least one pulse of energy to the receptacle to increase the
6 efficiency at which the powder may be extracted from the chamber when flowing a gas
7 through the chamber.
- 1 2. A method as in claim 1, further comprising providing the pulse of
2 energy while the powder is sealed within the chamber.
- 1 3. A method as in claim 1, wherein the pulse providing step further
2 comprises quickly striking the receptacle.
- 1 4. A method as in claim 3, further comprising striking the receptacle
2 with an amount of energy of at least about 0.01 lbf-in.
- 1 5. A method as in claim 3, further comprising releasing a spring-
2 loaded lever to quickly strike the receptacle.
- 1 6. A method as in claim 1, wherein the pulse providing step further
2 comprises moving the receptacle past an arm that temporarily engages a portion of the
3 receptacle.
- 1 7. A method as in claim 1, wherein the pulse providing step further
2 comprises bending and quickly releasing receptacle to permit receptacle to strike a
3 surface.
- 1 8. A method as in claim 1, wherein the pulse providing step further .
2 comprises providing a pulse of vibratory energy to the receptacle.
- 1 9. A method as in claim 8, further comprising contacting the
2 receptacle with a vibrating piezoelectric transducer to provide the vibratory energy.
- 1 10. A method as in claim 9, further comprising vibrating the transducer
2 at a frequency of at least about 10 kHz.

1 A 11. A method as in claim 1, wherein the powder is composed of fine
2 particles having a mean size in the range from about 0.5 μm to about 5 μm .

1 12. A method as in claim 1, further comprising providing at least one
2 pre-conditioning step prior to providing said at least one pulse of energy, wherein said
3 pre-conditioning step comprises vibrating the receptacle for a predetermined period of
4 time.

1 13. A method as in claim 1, wherein the receptacle is vibrated at a
2 frequency within the range of about 0.01 Hz to about 500 Hz..

1 14. A method as in claim 1, wherein the receptacle is vibrated for
2 about 0.01 minute to about 10 minutes.

1 15. A powder conditioning system comprising:
2 a receptacle having an enclosed chamber containing an amount of a
3 powder; and
4 a mechanism to provide at least one pulse of energy to the receptacle to
5 increase the efficiency at which the powder may be extracted from the chamber when
6 flowing a gas through the chamber.

1 16. A system as in claim 15, wherein the mechanism comprises a
2 striking device to quickly strike the receptacle.

1 17. A system as in claim 16, wherein the striking device is configured
2 to strike the receptacle with at least about 0.01 lbf-in in energy.

1 18. A system as in claim 16, wherein the striking device comprises a
2 spring-loaded lever arm, and a release apparatus to release the lever arm.

1 19. A system as in claim 18, further comprising a pivotal latch having
2 a lock that pivots as the receptacle is moved against the latch, and a trigger having a
3 ramp, wherein the lock of the latch is slidable upon the ramp when the latch pivots to
4 cause the lever arm to pivot and compress a first spring and cause the lock to engage the
5 trigger to lock the lever arm in an energy storage position.

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1 20. A system as in claim 19, further comprising a second spring that is
2 in contact with the trigger, wherein further movement of the receptacle causes the
3 receptacle to engage and move the trigger away from the lock to release the lever arm
4 which then strikes the receptacle.

1 21. A system as in claim 15, wherein the mechanism comprises a
2 bending device that is configured to bend and then quickly release the receptacle to
3 permit the receptacle to strike a surface.

1 22. A system as in claim 15, wherein the mechanism comprises an arm
2 that is mounted to a frame, and a movable platform to move the receptacle past the arm
3 while temporarily engaging the arm.

1 23. A system as in claim 15, wherein the mechanism comprises a
2 vibratable element that is configured to at least temporarily contact the receptacle.

1 24. A system as in claim 23, wherein the vibratable element comprises
2 a piezoelectric transducer.

1 25. A system as in claim 15, wherein the receptacle further comprises a
2 metallic body having a tab extending from the chamber.

1 26. A system as in claim 15, wherein the powder is composed of fine
2 particles having a mean size in the range from about 0.5 μm to about 5 μm .

1 27. A system as in claim 15, further comprising a container having an
2 enclosure, wherein the receptacle is held within the enclosure, and wherein the
3 mechanism is coupled to the container.

1 28. A system as in claim 27, wherein the container comprises a base
2 and a cover that is pivotally coupled to the base, wherein the base and the cover define the
3 enclosure.

1 29. A system as in claim 28, further comprising a coupling
2 arrangement that couples the receptacle to the base.

1 30. A system as in claim 28, wherein the mechanism comprises a hook
2 coupled to the cover that engages and then releases the receptacle when the cover is
3 pivoted to permit the receptacle to strike the base.

1 31. A system as in claim 29, wherein the coupling arrangement is
2 pivotally coupled to the base, and wherein the mechanism comprises a latch that is
3 operably coupled to the base, an arm that is coupled to the cover, and a cantilever beam
4 that is attached to the coupling arrangement, wherein the arm is configured to engage and
5 pivot the coupling arrangement as the cover is opened, and wherein the latch is
6 configured to engage and then release the cantilever beam when the coupling arrangement
7 is pivoted to permit the cantilever beam to strike the receptacle.

1 32. A system as in claim 31, wherein the latch is slidably coupled to
2 the base such that the latch may be moved over the cantilever beam after the receptacle
3 has been positioned within the enclosure.

1 33. A system as in claim 28, wherein the mechanism comprises a
2 spring that is coupled to the cover and a latch that is operably coupled to the base,
3 wherein the latch is operable to release the spring to permit the spring to strike the
4 receptacle.

1 34. A system as in claim 33, wherein the latch is slidably coupled to
2 the base such that the latch may be moved to release the spring after the cover has been
3 closed.

1 35. A system as in claim 15, further comprising a housing and a
2 plurality of receptacles that are stacked within the housing, and wherein the mechanism
3 comprises a biased striking member and a trigger that is movable between a home
4 position and a striking position, wherein movement of the trigger to the striking position
5 releases the striking member to permit the striking member to strike one of the
6 receptacles.

1 36. A system as in claim 35, further comprising an advancement
2 apparatus that is configured to advance the receptacles toward the striking member upon
3 movement of the trigger to the striking position, and further comprising a push plate

4 coupled to the trigger such that movement of the trigger back to the home position pushes
5 a treated receptacle from the housing.

1 37. A powder dispersion device, comprising:
2 a housing that is adapted to receive a receptacle having an enclosed
3 chamber containing an amount of a powder;
4 an aerosolization system in the housing to extract the powder from the
5 receptacle and to entrain the powder in a gas stream to form an aerosol;
6 a mechanism to provide at least one pulse of energy to the receptacle prior
7 to aerosolization to increase the efficiency at which the powder may be extracted from the
8 chamber when flowing a gas through the chamber.

1 38. A device as in claim 37, wherein the mechanism comprises a
2 striking device disposed in the housing to quickly strike the receptacle.

1 39. A device as in claim 37, wherein the striking device comprises a
2 spring-loaded lever arm, and a release apparatus to release the lever arm.

1 40. A device as in claim 37, further comprising a pivotal latch having a
2 lock that pivots as the receptacle is moved against the latch, and a trigger having a ramp,
3 wherein the lock of the latch is slidable upon the ramp when the latch pivots to cause the
4 lever arm to pivot and compress a first spring and cause the lock to engage the trigger to
5 lock the lever arm in an energy storage position.

1 41. A device as in claim 40, further comprising a second spring that is
2 in contact with the trigger, wherein further movement of the receptacle causes the
3 receptacle to engage and move the trigger away from the lock to release the lever arm
4 which then strikes the receptacle.

1 42. A device as in claim 37, wherein the mechanism comprises an arm
2 that is operably mounted to the housing, and a movable platform to move the receptacle
3 past the arm while temporarily engaging the arm.

1 43. A device as in claim 37, wherein the mechanism comprises a
2 vibratable element in the housing that is configured to at least temporarily contact the
3 receptacle.

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1 44. A device as in claim 43, wherein the vibratable element comprises
2 a piezoelectric transducer.

1 45. A device as in claim 37, wherein the aerosolization system
2 comprises a mouthpiece that is adapted to receive a patient's mouth to permit the patient
3 to create the gas stream.

1 46. A kit for aerosolizing a powder, comprising:
2 at least one receptacle having an enclosed chamber containing an amount
3 of a powder;
4 an aerosolization device having an opening for receiving the receptacle;
5 and
6 instructions describing a method for providing at least one pulse of energy
7 to the receptacle prior to aerosolizing the powder.

1 47. A kit as in claim 46, wherein the instructions describe manually
2 striking the receptacle with a finger or a hard surface.

1 48. A kit as in claim 46, further comprising a powder conditioning
2 device, and wherein the instructions describe placing the receptacle into the powder
3 conditioning device prior to placing the receptacle into the aerosolization device.

1 49. A kit as in claim 48, wherein the powder conditioning device
2 comprises a frame and a spring-loaded lever arm pivotally coupled to the frame, wherein
3 the lever arm is releasable to strike the receptacle.

1 50. A kit as in claim 49, wherein the instructions describe placing the
2 receptacle into the aerosolization device and operating a button on the aerosolization
3 device to supply an amount of energy to the receptacle to increase the efficiency at which
4 the powder may be extracted from the chamber when operating the device.

1 51. A powder conditioning device comprising:

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2 a container that is adapted to hold a receptacle having an enclosed chamber
3 containing an amount of a powder; and

4 a mechanism coupled to the container that is operable to provide at least
5 one pulse of energy to the receptacle to increase the efficiency at which the powder may
6 be extracted from the chamber when flowing a gas through the chamber.

1 52. A device as in claim 51, wherein the container comprises a base
2 and a cover that is pivotally coupled to the base, wherein the base and the cover define an
3 enclosure which is adapted to receive the receptacle.

1 53. A device as in claim 52, further comprising a coupling arrangement
2 is adapted to couple the receptacle to the base.

1 54. A device as in claim 53, wherein the mechanism comprises a hook
2 coupled to the cover that is adapted to engage and then release the receptacle when the
3 cover is pivoted to permit the receptacle to strike the base.

1 55. A device as in claim 53, wherein the coupling arrangement is
2 pivotally coupled to the base, and wherein the mechanism comprises a latch that is
3 operably coupled to the base, an arm that is coupled to the cover, and a cantilever beam
4 that is attached to the coupling arrangement, wherein the arm is configured to engage and
5 pivot the coupling arrangement as the cover is opened, and wherein the latch is
6 configured to engage and then release the cantilever beam when the coupling arrangement
7 is pivoted to permit the cantilever beam to strike the receptacle.

1 56. A device as in claim 55, wherein the latch is slidably coupled to the
2 base such that the latch may be moved over the cantilever beam after the receptacle has
3 been positioned within the enclosure.

1 57. A device as in claim 53, wherein the mechanism comprises a
2 spring that is coupled to the cover and a latch that is operably coupled to the base,
3 wherein the latch is operable to release the spring to permit the spring to strike the
4 receptacle.

1 58. A device as in claim 57, wherein the latch is slidably coupled to the
2 base such that the latch may be moved to release the spring after the cover has been
3 closed.

1 59. A device as in claim 51, wherein the container is adapted to hold a
2 plurality of stacked receptacles, and wherein the mechanism comprises a biased striking
3 member and a trigger that is movable between a home position and a striking position,
4 wherein movement of the trigger to the striking position releases the striking member to
5 permit the striking member to strike one of the receptacles.

1 60. A device as in claim 59, further comprising an advancement
2 apparatus that is configured to advance the receptacles toward the striking member upon
3 movement of the trigger to the striking position, and further comprising a push plate
4 coupled to the trigger such that movement of the trigger back to the home position pushes
5 a treated receptacle from the container.

1 61. A method for aerosolizing a powder, the method comprising:
2 placing a receptacle having a chamber containing an amount of a powder
3 into an aerosolization device having an aerosolization system for extracting the powder
4 from the receptacle and for entraining the powder in a gas stream to form an aerosol, and
5 a mechanism to provide at least one pulse of energy to the receptacle; and

6 providing a pulse of energy to the receptacle with the mechanism and
7 actuating the aerosolization system to extract the powder from the receptacle at about the
8 same.

1 62. A method as in claim 61, wherein the pulse of energy is provided
2 within about 100 ms before actuation of the aerosolization system to about 25 ms after
3 actuation of the aerosolization system.

1 63. A method as in claim 61, wherein the emitted dose is increased by
2 about 10% when the pulse of energy is provided at about the same time as actuation of
3 the aerosolization system.